

PATTERSON & SHERIDAN, L.L.P.
3040 Post Oak Blvd. Suite 1500
Houston, TX 77056
Telephone: (713) 623-4844
Facsimile: (713) 623-4846
Agent for Applicant(s)

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,026,238

Page 1 of 3

APPLICATION NO. : 10/052,681

DATED : Apr. 11, 2006

INVENTOR(S) : Ming Xi, Paul Frederick SMITH, Ling CHEN, Michael X. YANG, Mei CHANG, Fusen CHEN, Cristophe MARCADAL, Jenny C. LIN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the Cover of the Patent

Item [75], Inventors: Change Paul Frederick Smith's city of residence from "San Jose, CA" to --Campbell, CA--

Item [56], References Cited, U.S. PATENT DOCUMENTS: Please add the following references:

6,607,977	8/2003	Rozbicki et al.	438/627
6,498,091	12/2002	Chen et al.	438/627
2003/0087520	5/2003	Chen et al.	438/643
2002/0185370	12/2002	Gopalraja et al.	204/192.17
2002/0029958	3/2002	Chiang et al.	204/192.1
6,297,114	10/2001	Iwata et al.	438/305
5,792,272	8/1998	Van Os et al.	11B/723 IR
5,759,635	6/1998	Logan	427/490
5,565,074	10/1996	Qian et al.	204/298.08
5,397,962	3/1995	Moslehi	315/111.51
4,419,202	10/1983	Gibson	204/192 N
6,008,117 *	12/1999	Hong et al.	438/629
6,093,639 *	07/2000	Wu et al.	438/629
6,156,644 *	12/2000	Ko et al.	438/639
5,818,110 *	10/1998	Cronin	257/775
5,407,698 *	4/1995	Emesh	427/99
5,391,517 *	2/1995	Gelatos et al.	438/643
6,309,801	10/2001	Meijer et al.	430/313
6,274,483	8/2001	Chang et al.	438/640
6,271,592	8/2001	Kim et al.	257/751
6,271,084	8/2001	Tu et al.	438/253
6,268,283	7/2001	Huang	438/638
6,265,757	7/2001	Brady et al.	257/623
6,229,174	5/2001	Parekh	257/306
6,221,775	4/2001	Ference et al.	438/691
6,211,071	4/2001	Lukanc et al.	438/640
6,200,433	3/2001	Ding et al.	201/192.15
6,184,138	2/2001	Ho et al.	438/687
6,184,128	2/2001	Wang et al.	438/637
6,166,423	12/2000	Gambino et al.	257/532
6,164,138	12/2000	Blake et al.	73/732
6,164,128	12/2000	Santa Cruz, et al. ...	73/170.11
6,157,081	12/2000	Nariman et al.	257/752
6,157,061	12/2000	Kawata	257/316

MAILING ADDRESS OF SENDER (Please do not use customer number below):

Keith M. Tackett
PATTERSON & SHERIDAN, L.L.P.
3040 Post Oak Blvd., Suite 1500
Houston, TX 77056-6582

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,026,238

Page 2 of 3

APPLICATION NO. : 10/052,681

DATED : Apr. 11, 2006

INVENTOR(S) : Ming XI, Paul Frederick SMITH, Ling CHEN, Michael X. YANG, Mei CHANG, Fusen CHEN, Cristophe MARCADAL, Jenny C. LIN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

6,143,646	11/1000	Wetzel	438/637
6,023,102	2/2000	Nguyen et al.	257/774
6,017,817	1/2000	Chung et al.	438/637
5,993,916	11/1999	Zhao et al.	427/535
5,930,669	7/1999	Uzoh	438/627
5,846,332	12/1998	Zhao et al.	118/728
5,674,787	10/1997	Zhao et al.	437/230
5,654,232	8/1997	Gardner	438/661
5,613,296	3/1997	Kurino et al.	29/852
5,565,029	10/1996	Takasu	117/1
5,534,460	7/1996	Tseng et al.	437/187
5,486,492	1/1996	Yamamoto et al.	437/192
5,371,042	12/1994	Ong	437/194
5,354,712	10/1994	Ho et al.	437/195
5,308,793	5/1994	Taguchi et al.	437/194
5,186,718	2/1993	Tepman et al.	29/25.01
5,178,739	1/1993	Barnes et al.	204/192.12
4,962,060	10/1990	Sliwa et al.	437/192
4,951,601	8/1990	Maydan et al.	118/719

Item [56], References Cited, FOREIGN PATENT DOCUMENTS: Please add the following references:

JP 08-213,119 7/1996

Item [56], References Cited, OTHER PUBLICATIONS: Please add the following references:

Ghandi, Sorab K., "VLSI Fabrication Principles, Silicon and Gallium Arsenide" Second Edition, Wiley-Interscience Publication (1994), Pages 617-620 and Page 652.

R. F. Bunshah, "Handbook of Deposition Technologies for Films and Coatings", 2nd edition, Noyas Publications, NJ, USA, 1994, 261, 321-325.

Gardner et al., "Encapsulated Copper Interconnection Device using Sidewall Barriers", Thin Solid Films 262 (1995) 104-119.

Jang et al., "Tantalum and Niobium as a Diffusion Barrier between Copper and Silicon", J. Materials Science: Materials in Electronics 7 (1996) 271-278.

Tadashi Iijima, Yoshiakai Shimooka, and Kyoichi Suguro, "An Amorphous Ti-Si-N Diffusion Barrier Layer for Cu Interconnections," Vol. 78, No. 12, 1995, pages 67-74.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

Keith M. Tackett
PATTERSON & SHERIDAN, L.L.P.
3040 Post Oak Blvd., Suite 1500
Houston, TX 77056-6582

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,026,238

Page 3 of 3

APPLICATION NO. : 10/052,681

DATED : Apr. 11, 2006

INVENTOR(S) : Ming XI, Paul Frederick SMITH, Ling CHEN, Michael X. YANG, Mei CHANG, Fusen CHEN, Cristophe MARCADAL, Jenny C. LIN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Mikagi H. Ishikawa, T. Usami, M. Suzuki, K. Inoue, N. Oda, S. Chikaki, I. Sakai and T. Kikkawa.
"Barrier Metal Free Copper Damascene Interconnection Technology Using Atmospheric Copper Reflow and Nitrogen Doping in SiOF Film." 1996 IEEE. Pp. 365-368.

Y. Shacham-Diamand, V. Dubin, and M. Angyal "Electroless Copper Deposition for ULSI" 1995 Elsevier Science S.A., pp. 93-103.

Electromigration and Diffusion in Pure Cu and Cu(Sn) Alloys. C. K. Hu, K. L. Lee, D. Gupta, and P. Blauner, Mat. Res. Soc. Symp. Vol 427 (96-105).

Electromigration Failure Distributions for Multi-Large Interconnects as a Function of Line Width Experiments and Simulation, D.D. Brown, J.E. Sanchez, Jr., V. Pham, P.R. Besser, M.A. Korhonen, and C.Y. Li, Mat. Res. Soc. Symp. Vol 427.

USSN Serial No.: 09/635,738, Chen, et al., "Barrier Layer Structure for Copper Metallization and Method of Forming the Structure," Filed: August 09, 2000.

In the Specification

Column 5, Lines 34 and 35: Change each instance of "MHZ" to --MHZ--

Column 5, Line 35: Add a period after "MHZ"

Column 7, Line 47: Change "dc" to --DC--

Column 8, Line 12: After "fill", insert --of--

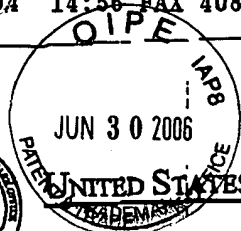
Column 8, Line 33: Change "Ta/aN" to --Ta/TaN--

MAILING ADDRESS OF SENDER (Please do not use customer number below):

Keith M. Tackett
PATTERSON & SHERIDAN, L.L.P.
3040 Post Oak Blvd., Suite 1500
Houston, TX 77056-6582

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22113-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

COPY

32588 7590 12/31/2003

APPLIED MATERIALS, INC.
2881 SCOTT BLVD. M/S 2061
SANTA CLARA, CA 95050

JAN - 5 2004

REC'D JAN 5 2004

EXAMINER	
FERALTA, GINETTE	
ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 12/31/2003

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/052,681	01/17/2002	Ming Xi	AMAT/1931.P1.CPI/ALUMINUM	4083

TITLE OF INVENTION: RELIABILITY BARRIER INTEGRATION FOR CU APPLICATION

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1330	\$300	\$1630	03/31/2004

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status is changed, pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above and notify the United States Patent and Trademark Office of the change in status, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check the box below and enclose the PUBLICATION FEE and 1/2 the ISSUE FEE shown above.

☐ Applicant claims SMALL ENTITY status.
See 37 CFR 1.27.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

Notice of Allowability

Application No.

10/052,681

Applicant(s)

XI ET AL

Examiner

Ginette Peralta

Art Unit

2814

MW

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

If claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS. This application is subject to withdrawal from issue at the Initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

COPY

- ☒ This communication is responsive to Amendment filed on 8/22/03.
- ☒ The allowed claim(s) is/are 1-38.
- ☒ The drawings filed on 17 January 2002 are accepted by the Examiner.
- ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
- * Certified copies not received: _____.
- ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- (a) ☐ The translation of the foreign language provisional application has been received.
- ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.
7. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
8. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No. _____.
- (b) ☐ including changes required by the proposed drawing correction filed _____, which has been approved by the Examiner.
- (c) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the margin according to 37 CFR 1.121(d).

9. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- 1 ☒ Notice of References Cited (PTO-892)
- 2 ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3 ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No. 9/03.11/03
- 4 ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material

- 5 ☐ Notice of Informal Patent Application (PTO-152)
- 6 ☐ Interview Summary (PTO-413), Paper No. _____
- 7 ☐ Examiner's Amendment/Comment
- 8 ☐ Examiner's Statement of Reasons for Allowance
- 9 ☐ Other

SUB

JUN 07 2006

Sheet 1 of 1 sheets

U.S. Department of Commerce, Patent and Trademark Office (PTO Form 1449 modified)		Docket No. AMAT/1931.P1/CPI/ COPPER/PJS	Serial No. 10/052,681
SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT		Applicant Xi, et al.	Confirmation No. 4083
(Use several sheets if necessary)		Filing Date January 17, 2002	Group 2814
Examiner Ginette Peralta			

U.S. Patent Documents

*Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate
GP	A1	6,607,977	08/19/2003	Rozbicki, et al.	438	627	09/26/2001
GP	A2	6,498,091	12/24/2002	Chen, et al.	438	627	11/01/2000
GP	A3	2003/0087520	05/08/2003	Chen, et al.	438	643	11/07/2002
GP	A4	2002/0185370	12/12/2002	Gopalraja, et al.	204	192.17	07/16/2002
GP	A5	2002/0029958	03/14/2002	Chiang, et al.	204	192.1	06/20/2001
	A6						
	A7						
	A8						
	A9						
	A10						
	A11						
	A12						
	A13						

Foreign Patent Documents

*Examiner Initial		Document Number	Date	Country	Class	Subclass	Translation	
							YES	NO
	B1						<input type="checkbox"/>	<input type="checkbox"/>
	B2						<input type="checkbox"/>	<input type="checkbox"/>
	B3						<input type="checkbox"/>	<input type="checkbox"/>
	B4						<input type="checkbox"/>	<input type="checkbox"/>
	B5						<input type="checkbox"/>	<input type="checkbox"/>

OTHER ART

*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.
	C1	
	C2	

Examiner *Ginette Peralta*

Date Considered 12/10/03

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with your communication to applicant.

JUN 27 2006

Sheet 1 of 1 sheets

U.S. Department of Commerce Patent and Trademark Office (PTO Form 1449 modified)		Docket No. AMAT/1931.P1/CPV/ COPPER/PJS	Serial No. 10/052,681
SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT		Applicant Xi, et al.	Confirmation No. 4083
(Use several sheets if necessary)		Filing Date January 17, 2002	Group 2814
Examiner Ginette Peralta			

U.S. Patent Documents

*Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date if Appropriate
SP	A1	6,297,114	10/02/2001	Iwata, et al.	438	305	12/04/1998
SP	A2	5,782,272	08/11/1998	Van Os, et al.	118	723 IR	08/12/1997
SP	A3	5,759,635	06/02/1998	Logan	427	490	07/03/1996
SP	A4	5,565,074	10/15/1996	Qian, et al.	204	298.08	07/27/1995
SP	A5	5,397,962	03/14/1995	Moslehi	315	111.51	06/29/1992
SP	A6	4,419,202	12/06/1983	Gibson	204	192 N	12/17/1981
	A7						
	A8						
	A9						
	A10						
	A11						
	A12						
	A13						

Foreign Patent Documents

*Examiner Initial		Document Number	Date	Country	Class	Subclass	Translation	
							YES	NO
	B1						<input type="checkbox"/>	<input type="checkbox"/>
	B2						<input type="checkbox"/>	<input type="checkbox"/>
	B3						<input type="checkbox"/>	<input type="checkbox"/>
	B4						<input type="checkbox"/>	<input type="checkbox"/>
	B5						<input type="checkbox"/>	<input type="checkbox"/>

OTHER ART

*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.
SP	C1	Ghandhi, Sorab K., "VLSI Fabrication Principles, Silicon and Gallium Arsenide" Second Edition, Wiley-Interscience Publication (1994), Pages 617-620 and Page 652.
	C2	
Examiner <i>Ginette Peralta</i>		Date Considered 12/10/03
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with your communication to applicant.		

Notice of References Cited

Application/Control No.

10/052,681

Applicant(s)/Patent Under
Reexamination
XI ET AL

Examiner

Ginette Peralta

Art Unit

2814

Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,008,117	12-1999	Hong et al.	438/629
	B	US-6,093,839	07-2000	Wu et al.	438/629
	C	US-6,156,644	12-2000	Ko et al.	438/639
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/052,681	01/17/2002	Ming Xi	AMAT/1931.P1.CPI/ALUMINUM	4083

32588 7590 06/19/2003

APPLIED MATERIALS, INC.
2881 SCOTT BLVD. M/S 2061
SANTA CLARA, CA 95050

EXAMINER

PERALTA, GINETTE

ART UNIT PAPER NUMBER

2814

DATE MAILED: 06/19/2003

OFC 9.19

Dead 12.19

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/052,681

Applicant(s)

XI ET AL.

Examiner

Ginette Peralta

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 March 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2. 6) ☐ Other:

300 07 2000

Notice of References Cited

Application/Control No.

10/052,681

Applicant(s)/Patent Under
Reexamination
XI ET AL.

Examiner

Ginette Peralta

Art Unit

2814

Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-5,818,110	10-1998	Cronin, John Edward	257/775
	B	US-5,407,698	04-1995	Emesh, Ismail T.	427/99
	C	US-5,391,517	02-1995	Gelatos et al.	438/643
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

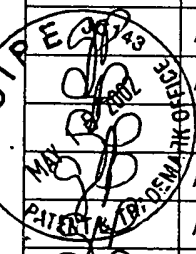
NON-PATENT DOCUMENTS


*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

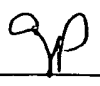
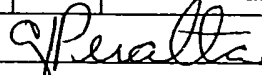
*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

JUL 07 2006

U.S. Department of Commerce, Patent and Trademark Office					Locket No.		Serial No.	
(PTO Form 1449 modified)					AM.../1931.P1		10/052,681	
LISTS OF PATENTS AND PUBLICATIONS CITED BY APPLICANT					Applicant Xi, et al.		Confirmation No.: 4083	
(Use several sheets if necessary)					Filing Date		Group	
Examiner Unknown					January 17, 2002		2814	

U.S. Patent Documents							
Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate
	A1	6,309,801	10-30-2001	Meijer, et al.	430	313	06-03-1999
	A2	6,274,483	08-14-2001	Chang, et al.	438	640	01-18-2000
	A3	6,271,592	08-07-2001	Kim, et al.	257	751	08-06-1999
	A4	6,271,084	08-07-2001	Tu, et al.	438	253	01-16-2001
	A5	6,268,283	07-31-2001	Huang	438	638	02-09-1999
	A6	6,265,757	07-24-2001	Brady, et al.	257	623	11-09-1999
	A7	6,229,174	05-08-2001	Parekh	257	306	12-08-1997
	A8	6,221,775	04-24-2001	Ference, et al.	438	691	09-24-1998
	A9	6,211,071	04-03-2001	Lukanc, et al.	438	640	04-22-1999
	A10	6,200,433	03-13-2001	Ding, et al.	204	192.15	11-01-1999
	A11	6,184,138	02-06-2001	Ho, et al.	438	687	09-07-1999
	A12	6,184,128	02-06-2001	Wang, et al.	438	637	01-31-2000
	A13	6,166,423	12-26-2000	Gambino, et al.	257	532	10-22-1999

Foreign Patent Documents								
Examiner Initial		Document Number	Date	Country	Class	Subclass	Translation	
							YES	NO
	B1	JP 08-213,119 Abstract Only	07-24-1996	JP	H01L	21/768		X
	B2							
	B3							

OTHER ART		
Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.
	C1	R.F. Bunshah, "Handbook of Deposition Technologies for Films and Coatings", 2 nd edition, Noyas Publications, NJ, USA, 1994, 261, 321-325.
	C2	Gardner et al., "Encapsulated Copper Interconnection Device using Sidewall Barriers", Thin Solid Films 262 (1995) 104-119.
	C3	Jang et al., "Tantalum and Niobium as a Diffusion Barrier between Copper and Silicon", J. Materials Science: Materials in Electronics 7 (1996) 271-278.
Examiner		
		Date Considered 6/11/03

***EXAMINER:** Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with your communication to applicant.

U.S. Department of Commerce, Patent and Trademark Office				Locket No.		Serial No.	
(PTO Form 1449 modified)				AM. 1931.P1		10/052,681	
LISTS OF PATENTS AND PUBLICATIONS CITED BY APPLICANT				Applicant Xi, et al.		Confirmation No.: 4083	
(Use several sheets if necessary)				Filing Date		Group	
Examiner Unknown				January 17, 2002		2814	
U.S. Patent Documents							
Examiner Initial	Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate	
GP	A14	6,164,138	Blake, et al.	73	732	03-31-1998	
GP	A15	6,164,128	Santa Cruz, et al.	73	170.11	10-13-1999	
GP	A16	6,157,081	Nariman, et al.	257	752	03-10-1999	
GP	A17	6,157,061	Kawata	257	316	08-27-1998	
GP	A18	6,143,646	Wetzel	438	637	06-03-1997	
GP	A19	6,023,102	Nguyen, et al.	257	774	10-08-1998	
GP	A20	6,017,817	Chung, et al.	438	637	05-10-1999	
GP	A21	5,993,916	Zhao et al.	427	535	09-22-1997	
GP	A22	5,930,669	Uzoh	438	627	04-03-1997	
GP	A23	5,846,332	Zhao et al.	118	728	07-12-1996	
GP	A24	5,674,787	Zhao, et al.	437	230	01-16-1996	
GP	A25	5,654,232	Gardner	438	661	03-15-1996	
GP	A26	5,613,296	Kurino et al.	29	852	04-13-1995	
Foreign Patent Documents							
Examiner Initial	Document Number	Date	Country	Class	Subclass	Translation	
						YES	NO
	B4						
	B5						
	B6						
OTHER ART							
Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.					
GP	C4	Tadashi Iijima, Yoshiakai Shimooka, and Kyoichi Suguro, "An Amorphous Ti-Si-N Diffusion Barrier Layer for Cu Interconnections," Vol. 78, No. 12, 1995, pages 67-74					
GP	C5	Mikagi H. Ishikawa, T. Usami, M. Suzuki, K. Inoue, N. Oda, S. Chikaki, I. Sakai and T. Kikkawa. "Barrier Metal Free Copper Damascene Interconnection Technology Using Atmospheric Copper Reflow and Nitrogen Doping in SiOF Film. 1996 IEEE. Pp. 365-368					
GP	C6	Y. Shacham-Diamand, V. Dubin, and M. Angyal "Electroless Copper Deposition for ULSI" 1995 Elsevier Science S.A., pp. 93-103					
Examiner <i>GP Pratta</i>				Date Considered <i>6/1/03</i>			
<p>*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with your communication to applicant.</p>							

U.S. Department of Commerce, Patent and Trademark Office				Sheet 3 of 3 sheets			
(PTO Form 1449 modified)				Basket No. AM- 1931.P1 Serial No. 10/052,681			
LISTS OF PATENTS AND PUBLICATIONS CITED BY APPLICANT (Use several sheets if necessary)				Applicant Xi, et al. Filing Date January 17, 2002 Group Unknown			
Examiner Unknown							
U.S. Patent Documents							
Examiner Initial	Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate	
gp	A27	5,565,029	Takasu	117	1	03-31-1995	
gp	A28	5,534,460	Tseng et al.	437	187	04-27-1995	
gp	A29	5,486,492	Yamamoto et al.	437	192	10-29-1993	
gp	A30	5,371,042	Ong	437	194	06-16-1992	
gp	A31	5,354,712	Ho et al.	437	195	11-12-1992	
gp	A32	5,308,793	Taguchi et al.	437	194	07-22-1992	
gp	A33	5,186,718	Tepman, et al.	29	25.01	04-15-1991	
gp	A34	5,178,739	Barnes et al.	204	192.12	09-25-1991	
gp	A35	4,962,060	Sliwa, et al.	437	192	05-02-1989	
gp	A36	4,951,601	Maydan, et al.	118	719	06-23-1989	
	A37						
	A38						
	A39						
Foreign Patent Documents							
Examiner Initial	Document Number	Date	Country	Class	Subclass	Translation	
						YES	NO
	B07						
	B08						
	B09						
OTHER ART							
Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.					
gp	C7	Electromigration and Diffusion in Pure Cu and Cu(Sn) Alloys. C. K. Hu, K. L. Lee, D. Gupta, and P. Blauner, Mat. Res. Soc. Symp. Vol 427 (96-105)					
gp	C8	Electromigration Failure Distributions for Multi-Large Interconnects as a Function of Line Width Experiments and Simulation, D.D. Brown, J.E. Sanchez, Jr., V. Pham, P.R. Besser, M.A. Korhonen, and C.Y. Li, Mat Res. Soc. Symp. Vol 427					
gp	C9	USSN Serial No.: 09/635,738, Chen, et al., "Barrier Layer Structure for Copper Metallization and Method of Forming the Structure," Filed: August 09, 2000.					
Examiner <i>Yvette Rualta</i>				Date Considered 6/11/03			
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with your communication to applicant.							



Atty. Dkt. No. AMAT/1931.P1/CPI/ALUMINUM/PJS

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

This declaration is of the following type:

- ☐ original
- ☐ divisional
- ☐ continuation
- ☒ continuation-in-part

COPY

INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

RELIABILITY BARRIER INTEGRATION FOR CU APPLICATION

SPECIFICATION IDENTIFICATION

The specification of which:

- ☒ is attached hereto
- ☐ was filed on _____, under Serial No. _____, executed on even date herewith; or
- ☐ Express Mail No. (as Serial No. not yet known) and was amended on _____ (if applicable)
- ☐ was described and claimed in PCT International Application No. _____ filed on _____ and as amended under PCT Article 19 on _____.

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information I know to be material to patentability in accordance with

Title 37, Code of Federal Regulations, 1.56, and which is material to the examination of this application; namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

- ☐ In compliance with this duty there is attached an Information Disclosure Statement in accordance with 37 CFR 1.98.

1/2/06

PRIORITY CLAIM (35 U.S.C. 119)

I hereby claim foreign priority benefits under Title 35, United States Code, 119, of any provisional or foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below, and have also identified below any provisional or foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

☒ No such applications have been filed.

☐ Such applications have been filed as follows:

- A. Prior foreign/PCT application(s) filed within 12 mos. (6 mos. for design) prior to this application, and any priority claims under 35 U.S.C. 119

<u>Country/PCT</u>	<u>Application No</u>	<u>Date Filed</u>	<u>Priority Claimed</u>
			<input type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No

- B. All foreign application(s), if any, filed more than 12 mos. (6 mos for design) prior to this U.S. application

Country:
Application No:
Filing date:

- C. U.S. Provisional Application filed within 12 months prior to this application

<u>Serial No.</u>	<u>Filing Date</u>
-------------------	--------------------

PRIORITY CLAIM (35 U.S.C. 120)

I hereby claim the benefit under Title 35, United States Code, 120, of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, 112, I acknowledge the duty to disclose information that is material to the examination of this application (namely, information where there is substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

☐ No such applications have been filed

☒ Such applications have been filed, as follows:

<u>Serial No.</u>	<u>Filing Date</u>	<u>Patented</u>	<u>Pending</u>	<u>Status</u> <u>Abandoned</u>
08/856,116	May 14, 1997		Pending	

POWER OF ATTORNEY

I hereby appoint the following attorneys and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Donald Verplancken	Registration No. 33,217
Michael B. Einschlag	Registration No. 29,301
Peter J. Sgarbossa	Registration No. 25,610
Lawrence Edelman	Registration No. 25,226
Michael L. Sherrard	Registration No. 28,041
Raymond Kam-On Kwong	Registration No. 37,165
James C. Wilson	Registration No. 35,412
Robert W. Mulcahy	Registration No. 25,436
Walter Benjamin Glenn	Registration No. 44,713
B. Todd Patterson	Registration No. 37,906
Raymond R. Moser, Jr.	Registration No. 34,682
Keith M. Tackett	Registration No. 32,008
Douglas H. Elliott	Registration No. 32,982
William B. Patterson	Registration No. 34,102

COPY

Send correspondence to:

Direct telephone calls to:

Patent Counsel
Applied Materials, Inc.
P.O. Box 450-A
Santa Clara, CA 95052

B. Todd Patterson
MOSER, PATTERSON & SHERIDAN, L.L.P.
713-623-4844

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and, further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Sec. 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.

Full name of **first** inventor: MING XI

Inventor's signature: _____ Date: _____

Residence: 138 Beaumere Way
Milpitas, CA 95035

Post Office Address: SAME AS ABOVE
U.S.A.

Country of Citizenship: P.R. CHINA

Full name of **second** inventor: PAUL FREDERICK SMITH

Inventor's signature: Paul Frederick Smith Date: 01/10/02

Residence: 225 E. Taylor Street #4
San Jose, CA 95112

Post Office Address: SAME AS ABOVE
U.S.A. (B)

Country of Citizenship: USA

955 Stonehurst Way
Campbell, CA 95008